

Low-Stress Iridium Coatings for Thin-Shell X-Ray Telescopes, Phase II

Completed Technology Project (2009 - 2011)



Project Introduction

We propose to develop and commercialize a new type of low-stress iridium (Ir) X-ray mirror coating technology that can be used for the construction of high-resolution X-ray telescopes comprising thin-shell mirror substrates, such as the Flight Mirror Array (FMA) currently being developed for the IXO mission. The urgent need for low-stress Ir coating technology is driven by the current limitations on telescope angular resolution resulting from substrate distortions caused by conventional reflective Ir coatings that typically have very high stress. In particular, we have measured film stresses in excess of 4 GPa in the case of Ir films deposited by conventional magnetron sputtering. It is thought that the distortions in the thin glass mirror shells (such as those proposed for the IXO FMA) resulting from such extremely large coating stresses presently make the largest contribution to the telescope imaging error budget, of order 10 arcsec or more. Consequently, it will be difficult, if not impossible, to meet the imaging requirements of IXO, or other high-resolution X-ray missions in the future that use thin-shell mirror technology, unless high-quality Ir coatings having significantly lower stresses can be developed. The development of such coatings is precisely the aim of our proposal. Specifically, building on our successful Phase I effort, we propose to complete the development of low-stress Ir/Cr bilayers, and also investigate the use of Ir/Ti bilayers. We also propose to investigate the properties single-layer Ir films, as well as Ir/Cr and Ir/Ti bilayers, prepared by reactive sputtering with nitrogen. Finally, we plan to transfer the low-stress Ir coating technology to our large, production-class sputtering system so that we can coat GSFC-supplied thin-shell mirror substrates and conclusively demonstrate reduced stress-driven substrate distortions.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
Reflective X-Ray Optics LLC	Supporting Organization	Industry	New York, New York

Primary U.S. Work Locations

Maryland	New York
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Project Transitions

 **December 2009:** Project Start

 **December 2011:** Closed out

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.2 Observatories
 - └ TX08.2.1 Mirror Systems